

# PATENT ABSTRACTS OF JAPAN

(11) Publication number : 11-239758

(43) Date of publication of application : 07.09.1999

(51) Int.Cl.

B05C 11/08

G03F 7/30

H01L 21/027

(21) Application number : 10-044893

(71) Applicant : DAINIPPON SCREEN MFG CO LTD

(22) Date of filing : 26.02.1998

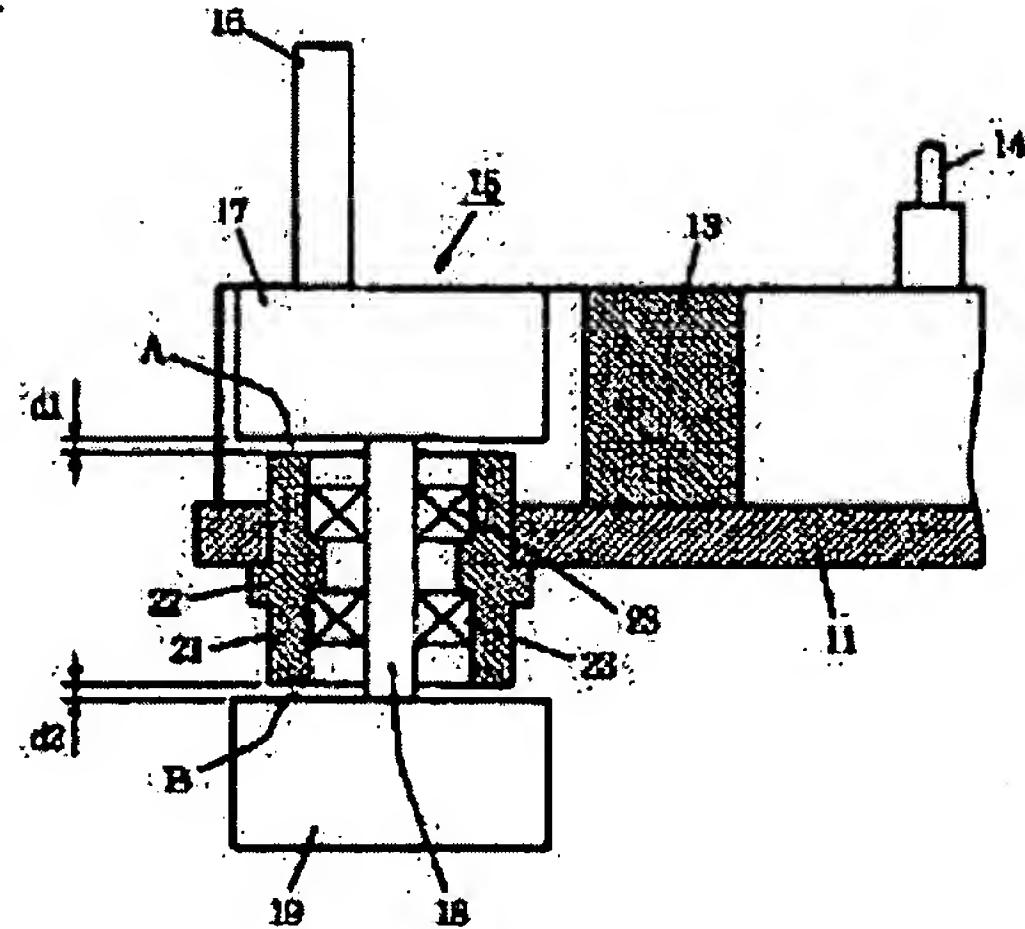
(72) Inventor : YABE MANABU

## (54) SUBSTRATE TREATMENT APPARATUS

### (57) Abstract:

**PROBLEM TO BE SOLVED:** To provide a substrate treatment apparatus in which the contamination of the substrate by the mist of treating liquid adhered to a member for rotating/ holding the substrate is prevented.

**SOLUTION:** The rotation member 11 of a substrate holding part is equipped with support pins 14 for supporting the substrate and a rotary holding pin 15 for regulating the horizontal position of the substrate, fixed to the upper end of the rotary shaft of a motor, rotated, and driven. A member in which the surface of a metal is coated with a fluororesin or the surface of an aluminum base material is plated with nickel-polytetrafluoroethylene and others are used as the rotation member 11. The pin fixing part 17 of the rotary holding pin 15, a magnet housing part 19, and a fitting member 22 are formed from a water repellent resin such as polypropylene, and the clearances A, B between the pin fixing part 17 and fitting member 22 and between the magnet housing part 19 and the pin fixing part 17 are adjusted to be 0.5-1.0 mm.



**\* NOTICES \***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

**CLAIMS**

---

**[Claim(s)]**

[Claim 1] Are a substrate processing device which performs predetermined processing to a substrate, rotating a substrate, and A rotation member which can be rotated freely, Two or more attachment components which are provided on said rotation member so that an outer peripheral part of a substrate may be met, and hold a substrate in contact with a peripheral end of a substrate, A substrate processing device, wherein the surface of said rotation member which counters the surface of a substrate which was provided with a driving means which rotates said rotation member, and a processing liquid supplying means which supplies processing fluid to a substrate held by said two or more attachment components, and was held by said two or more attachment components has water repellence.

[Claim 2] The axis of rotation which said each attachment component penetrates said rotation member, and is prolonged in the perpendicular direction, A mounting part which is fixed to said rotation member and supports said axis of rotation enabling free rotation, A supporter attached to an upper bed of said axis of rotation, and an attaching part which carried out eccentricity to said axis of rotation, and was provided on said supporter so that a peripheral end of a substrate might be contacted with rotation of said supporter, The surface of said mounting part [ in / at least / it is attached to a lower end of said axis of rotation, has a magnet storage part which stores a magnet which generates magnetism for rotation of said supporter and / a crevice between said mounting part and said supporter ], and said supporter, The substrate processing device according to claim 1, wherein the surface of said mounting part in a crevice between said mounting part and said magnet storage part and said magnet storage part has water repellence.

[Claim 3] The substrate processing device according to claim 2 with which a crevice between said mounting part and said supporter and a crevice between said mounting part and said magnet attaching part are characterized by 0.5-mm or more being 1.0 mm or less.

[Claim 4] The substrate processing device according to any one of claims 1 to 3 with which an angle of contact over water in the surface of said rotation member is characterized by not less than 70-degree being 180 degrees or less.

---

[Translation done.]

**\* NOTICES \***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

## DETAILED DESCRIPTION

---

### [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the substrate processing device which supplies processing fluid to a substrate and performs predetermined processing, rotating a substrate.

[0002]

[Description of the Prior Art] In order to perform various processings to substrates, such as a semiconductor wafer, a glass substrate for liquid crystal displays, a glass substrate for photo masks, and a glass substrate for optical discs, the revolving substrate processing device is used. For example, the revolving developer is used for the development of the photosensitive film formed on the surface of the substrate. The development of the substrate using this developer consists of each process of developing solution supply, developing solution maintenance, pure water washing, and desiccation.

[0003] Drawing 5 is an outline sectional view of the conventional developer, and shows the developing solution supply process. A developer is provided with the substrate attaching part 41 holding the substrate W in drawing 5. The substrate attaching part 41 is provided with the rotation member 42 which is fixed at a level with the point of the axis of rotation 50 of a motor (not shown), and is rotated around the axis of the perpendicular direction. While two or more holding pins 43 which support the rear face of the substrate W are formed, two or more control pins 44 which regulate the horizontal position of the substrate W in contact with the peripheral end of the substrate W are formed in the upper surface of the rotation member 42.

[0004] The development nozzle 51 which carries out the regurgitation of the developing solution is formed above the substrate attaching part 41 movable to the sliding direction and the horizontal direction. Before developing solution supply and after developing solution supply, the development nozzle 51 stands by in the position from which it separated from the upper part of the substrate W, and moves above the central part of the substrate W at the time of developing solution supply.

[0005] After the substrate W was held in the developing solution supply process using this developer at the substrate attaching part 41, The substrate attaching part 41 rotates by a motor, and from the development nozzle 51 which moved above the substrate W in this state, the developing solution 30 can be breathed out on the substrate W, and it applies all over the substrate W according to the centrifugal force accompanying rotation, and can extend.

[0006] In a developing solution holding process, rotation of the substrate attaching part 41 is suspended, and after the developing solution 30 applied all over the substrate W and has extended, fixed time stillness of the substrate W is carried out. Thereby, the development of the photosensitive film of the substrate W advances.

[0007] In a pure-water-washing process, the substrate attaching part 41 rotates again, pure water is supplied to the surface of the substrate W from a pure water feeding nozzle (not shown), and pure water washing of the surface of the substrate W is performed.

[0008]In a drying stage, after supply of pure water is suspended, the substrate attaching part 41 rotates at high speed, and pure water is shaken off from the surface of the substrate W by the centrifugal force accompanying rotation. Thereby, the substrate W dries. Then, rotation of the substrate attaching part 41 stops and the development of the substrate W is completed.

[0009]

[Problem to be solved by the invention]In the developing solution supply process shown in drawing 5, after the substrate W held at the substrate attaching part 41 has rotated at a low speed, the developing solution 30 is breathed out by the surface of the substrate W from the developer nozzle 51. If it is breathed out so much so that the developing solution 30 may spread uniformly all over the substrate W, the developing solution 30 is transmitted from the outer peripheral part of the substrate W in the holding pin 43 or the control pin 44, will flow into the rotation member 42, will fall, and will adhere to the outer peripheral part of the rotation member 42.

[0010]Then, if rotation of the substrate W is suspended, the adhesion region of the developing solution 30 which fell to the rotation member 42 spreads, as for some developing solutions 30, it will be crowded and the surroundings will adhere to the undersurface side of the rotation member 42.

[0011]As described above, after a developing solution supply process, a pure-water-washing process is performed through a developing solution holding process. In a pure-water-washing process, pure water is supplied to the surface of the substrate W, and the surface of the substrate W is washed. At this time, pure water flows and falls also to the rotation member 42 side, and the developing solution 30 which adhered to the rotation member 42 in the previous developing solution supply process is flushed selectively.

[0012]However, since pure water is supplied in the state where the substrate attaching part 41 is rotating, it receives a centrifugal force toward the way side outside the substrate W. For this reason, pure water cannot flush thoroughly the developing solution 30 which spread on the upper surface and the undersurface of the rotation member 42 at the time of stillness, but the adhesion region of the developing solution 30 remains on the upper surface and the undersurface of the rotation member 42.

[0013]If the high velocity revolution of the substrate attaching part 41 is carried out in a drying stage, in the cup 45, it will become mist (liquid particles), the adhesion region of this developing solution will float, and the reattachment will be carried out to the surface of the substrate W, and it will pollute the substrate W. If the developing solution which adhered to the upper surface and the undersurface of the rotation member 42 over the long period of time solidifies, the particle (dust) by the solidifying material of a developing solution will occur, it will float in the cup 45, and the substrate W will be polluted.

[0014]The purpose of this invention is to provide the substrate processing device by which contamination of the substrate by the mist of the processing fluid adhering to the component which carries out rotation maintenance of the substrate was prevented.

[0015]

[The means for solving a technical problem and an effect of the invention] The substrate processing device concerning the 1st invention is a substrate processing device which performs predetermined processing to a substrate, rotating a substrate, and The rotation member which can be rotated freely, Two or more attachment components which are provided on a rotation member so that the outer peripheral part of a substrate may be met, and hold a substrate in contact with the peripheral end of a substrate, It has a driving means which rotates a rotation member, and a processing liquid supplying means which supplies processing fluid to the substrate held by two or more attachment components, and the surface of the rotation member which counters the surface of the substrate held by two or more attachment components has water repellence.

[0016]In the substrate processing device concerning the 1st invention, the substrate held on the rotation member by two or more attachment components rotates by a driving means. A processing liquid supplying means supplies processing fluid to the substrate on a rotation member, and makes

predetermined processing perform to a substrate. If a lot of processing fluid is supplied to a substrate from a processing liquid supplying means, it will flow on a rotation member and the part will fall from a substrate. The surface of a rotation member has water repellence. For this reason, the processing fluid which flowed on the rotation member and fell is flipped on the surface of a rotation member, and disperses to the method of outside by rotation of a rotation member. It can prevent processing fluid being prevented from adhering on the surface of a rotation member by this, and the processing fluid which adhered on the surface of the rotation member serving as mist, and polluting a substrate face.

[0017]The substrate processing device concerning the 2nd invention is provided with the following. The axis of rotation in which each attachment component penetrates a rotation member, and is prolonged in the perpendicular direction in the composition of the substrate processing device concerning the 1st invention.

The mounting part which is fixed to a rotation member and supports the axis of rotation enabling free rotation.

The supporter attached to the upper bed of the axis of rotation.

The attaching part which carried out eccentricity to the axis of rotation, and was provided on the supporter so that the peripheral end of a substrate might be contacted with rotation of a supporter, and the magnet storage part which stores the magnet which is attached to the lower end of the axis of rotation, and generates the magnetism for rotation of a supporter.

The surface of the mounting part in the crevice between a mounting part and a supporter and a supporter and the surface of the mounting part in the crevice between a mounting part and a magnet storage part and a magnet storage part have water repellence at least.

[0018]The attaching part of each attachment component holds a substrate horizontally in contact with the peripheral end of a substrate. For this reason, it passes along an attaching part, and some processing fluid supplied to the substrate is transmitted to a mounting part, a supporter, and a magnet storage part, it flows and it falls. In the attachment component, the crevice is established between a mounting part and a supporter and between the mounting part and the magnet storage part so that rotation of the axis of rotation may be attained to a rotation member. And it is formed so that the surface of the mounting part in this crevice and a supporter and the surface of a mounting part and a magnet storage part may have water repellence. For this reason, it is barred that the processing fluid which flowed and fell from the substrate invades in a crevice by the water repellence of these surfaces. So, processing fluid invading, and the processing fluid which invaded serving as mist, dispersing in a post process, in each crevice between a mounting part and a magnet storage part, and a supporter, and polluting a substrate is prevented. It can prevent the processing fluid which invaded into each crevice solidifying, and barring the rotating operation of the axis of rotation of an attachment component.

[0019]In the composition of the substrate processing device which the substrate processing device concerning the 3rd invention requires for the 2nd invention, the crevice between a mounting part and a supporter and the crevice between a mounting part and a magnet attaching part are 0.5 mm or more 1.0 mm or less.

[0020]Processing fluid can be prevented from invading into each crevice by water-repellent operation of the surface within each crevice by the crevice between a mounting part and a supporter and the crevice between a mounting part and a magnet attaching part being 0.5 mm or more 1.0 mm or less. When each crevice is smaller than 0.5 mm, the crevice between a mounting part, a supporter and a mounting part, and a magnet attaching part becomes minute, high degree of accuracy is required of attachment of each component, and assembling work becomes difficult.

When each crevice is larger than 1.0 mm, a water-repellent operation of the surface within each crevice becomes small, and processing fluid invades into each crevice. Therefore, invasion of the processing fluid to each crevice can be prevented by setting each crevice as the above-mentioned value.

[0021]In composition of a substrate processing device which a substrate processing device concerning the 4th invention requires for the 1st – the 3rd one of invention, an angle of contact over water in the surface of a rotation member is not less than 70 degrees 180 degrees or less.

[0022]In this case, when an angle of contact which touches water of the surface of a rotation member is smaller than 70 degrees, it becomes difficult to fully flip processing fluid. Therefore, when an angle of contact over water considers it as 180 degrees or less at not less than 70 degrees, processing fluid which flows into a rotation member and falls is dispersed to a method of outside, and adhesion of processing fluid can be prevented.

[0023]

[Mode for carrying out the invention]Drawing 1 is a sectional view of a revolving developer by one embodiment of this invention, and drawing 2 is a top view of a developer in drawing 1.

[0024]The substrate attaching part 1 is provided with the tabular circular rotation member 11 in drawing 1 and drawing 2. The rotation member 11 uses aluminum for base metal, and nickel polytetrafluoroethylene plating is performed to the surface which counters the surface of the substrate W. The angle of contact over the water of nickel polytetrafluoroethylene plating is as large as about 100 degrees, and can flip a developing solution. As other examples, what coated with fluororesin the surface of metallic materials, such as a thing which carried out impregnation treatment of the water-repellent resin to alumite, or a titanium alloy (coating treatment) may be used.

[0025]It is horizontally fixed at the tip of the axis of rotation 2 of the motor 3 via the attaching member 12, and the rotation member 11 is rotated around the axis of the perpendicular direction.

[0026]The annular cover member 13 which consists of resin is formed in the upper surface of the rotation member 11, and two or more holding pins 14 which support the rear face of the substrate W have projected from the upper surface of this cover member 13.

[0027]Two or more revolving hold pins 15 which regulate the horizontal position of the substrate W are attached to the rotation member 11 rotatable around the axis of the perpendicular direction.

Drawing 3 is a perspective view of revolving hold pins (a) and an attaching member (b). Drawing 4 is an expanded sectional view near [ in a developer ] the revolving hold pins. The revolving hold pins 15 are provided with the cylindrical pin fixed parts 17, the pin member 16 of cylindrical shape (rod form), the connecting shaft 18, and the magnet storage part 19 in drawing 3 (a) and drawing 4. To the center of the pin fixed parts 17, eccentricity of the pin member 16 is carried out to the upper surface of the pin fixed parts 17, and it is provided in it. The magnet storage part 19 is being fixed to the lower part of the pin fixed parts 17 via the connecting shaft 18. The cylindrical permanent magnet 20 is stored in the magnet storage part 19.

[0028]The revolving hold pins 15 are attached to the rotation member 11 by the attaching member 22. In drawing 3 (b), the attaching member 22 has one pair of mounting holes 22a, and is screwed and fixed to the undersurface periphery of the rotation member 11 (refer to drawing 1). The attaching member 22 has the bearing storage part 21, and the connecting shaft 18 of the revolving hold pins 15 is inserted in in the boss of the bearing 23 stored in the bearing storage part 21.

Thereby, as shown in drawing 4, the pin member 16 and the pin fixed parts 17 of the revolving hold pins 15 project to the upper surface side of the rotation member 11, and the magnet storage part 19 of the revolving hold pins 15 projects in the undersurface side of the rotation member 11.

[0029]In the revolving hold pins 15, the pin member 16, the pin fixed parts 17, the attaching member 22, and the magnet storage part 19 are formed from resin, such as polo propylene which has water repellence, or polytetrafluoroethylene. The angle of contact of about 80 degrees and polytetrafluoroethylene is 90–100 degrees, and the angle of contact over the water of polypropylene both has high water repellence. For this reason, the laminated developing solution can be flipped and it can be made to flow down. These components may use what it not only forms with the resin material which has the above-mentioned water repellence, but performed surface treatments, such as a thing which coated the surface of the metallic material with water-repellent materials, such as

polytetrafluoroethylene, or fluoridation graphite. The angle of contact over the water of fluoridation graphite is 140–180 degrees.

[0030]In drawing 4, the interval d1 of the crevice B formed between the crevice A and the attaching member 22, and the magnet storage part 19 which are formed between the pin fixed parts 17 and the attaching member 21, and d2 are adjusted to 0.5 mm or more 1 mm or less. The surface of the pin fixed parts 17 in each crevices A and B, the attaching member 22, and the magnet storage part 19 has water repellence. For this reason, by adjusting the interval d1 of each crevice, and d2 to 1 mm or less, a developing solution is flipped by the water repellence of the surface of each component which counters via the crevices A and B, and passing the crevices A and B is barred. A developing solution is prevented from a developing solution invading in the bearing attaching part 21, and stagnating, or covering the bearing 23 of non-water repellence by this. If the interval d1 of each crevice and d2 become smaller than 0.5 mm, high accuracy will be required of adjustment of a crevice and assembling work will become difficult.

[0031]The ring magnet 6 is allocated under the rotation member 11. This ring magnet 6 is being fixed to the magnet support component 7 provided by the drive (not shown) enabling free up-and-down motion.

[0032]If the magnet support component 7 goes up, the ring magnet 6 and the permanent magnet 20 of the revolving hold pins 15 pay well, the revolving hold pins 15 will rotate and the pin member 16 will hold the horizontal position of the substrate W in contact with the peripheral end of the substrate W. If the magnet support component 7 descends, the revolving hold pins 15 will rotate to an opposite direction, and the pin member 16 will estrange from the peripheral end of the substrate W. The peripheral end of the substrate W is held with the revolving hold pins 15 by such operation, or is wide opened by it.

[0033]The axis of rotation 2 of the motor 3 is constituted by the hollow shaft, and the back rinse nozzle 9 (refer to drawing 2) for rear-face washing of a substrate is inserted in the inside. This back rinse nozzle 9 penetrated the attaching member 12, and has projected it to the rear-face side of the substrate W. The truncated cone form cap 8 is attached at the tip of the back rinse nozzle 9. The cap 8 is attached in order that the rinse (pure water) breathed out from the back rinse nozzle 9 may prevent invading into the inside of the axis of rotation 2.

[0034]The development nozzle 10 which carries out the regurgitation of the developing solution is formed above the substrate attaching part 1 movable to a sliding direction and a horizontal direction. Before a development and after a development, this development nozzle 10 stands by in a position from which it separated from the upper part of the substrate W, and moves above the central part of the substrate W at the time of a development.

[0035]The cup 4 in the air is allocated so that the circumference of the substrate attaching part 1 may be surrounded. The cup 4 consists of the upper cup 4a movable to a sliding direction, and the lower cup 4b fixed under the upper cup 4a. The exhaust port 4c for exhausting a downward current (downflow) of pure air which descends to the lower part of the lower cup 4b in the cup 4 from the upper part of a developer is established.

[0036]In this example, the revolving hold pins 15 are equivalent to an attachment component of this invention, the motor 3 is equivalent to a driving means, and the development nozzle 10 is equivalent to a processing liquid supplying means. The pin member 16 of the revolving hold pins 15 is equivalent to an attaching part of this invention, the pin fixed parts 17 are equivalent to a supporter, the connecting shaft 18 is equivalent to the axis of rotation, the magnet storage part 19 is equivalent to a magnet storage part, and the attaching member 22 is equivalent to a mounting part.

[0037]Next, operation at the time of a development in a developer of drawing 1 is explained. A development is performed in this developer, a pure downflow being supplied within and without the cup 4 from the upper part. In a development, each process of developing solution supply, developing solution maintenance, pure water washing, and desiccation is performed in order.

[0038]First, the substrate W is laid on the holding pin 14 of the substrate attaching part 1. Next, the

ring magnet 6 goes up and two or more revolving hold pins 15 hold the substrate W horizontally. [0039] In a developing solution supply process, after the substrate attaching part 1 has rotated by the motor 3 at a low speed, a developing solution is breathed out on the substrate W from the development nozzle 10. The breathed-out developing solution is uniformly applied all over the substrate W, and can be opened.

[0040] From the development nozzle 10, comparatively a lot of developing solutions are breathed out. For this reason, some developing solutions are transmitted in the revolving hold pins 15, it flows into the rotation member 11 and it falls. The surface of the revolving hold pins 15 and the rotation member 11 has water repellence. For this reason, the developing solution which flowed and fell from the substrate W disperses in the method of outside by rotation of the substrate attaching part 1, without adhering to the surface of the revolving hold pins 15 and the rotation member 11.

[0041] Rotation of the substrate attaching part 1 is suspended in a developing solution holding process. If the substrate attaching part 1 is stopped, the ring magnet 6 will descend and the revolving hold pins 15 will be in a release position. In this state, fixed time stationary holding of the developing solution is carried out on the substrate W. Thereby, the development of the photosensitive film on the substrate W advances. In this case, the developing solution appears in the surface of the rotation member 11 in the state where it crawled without adhering to the surface of the revolving hold pins 15 and the rotation member 11, and if a centrifugal force works by rotation of the rotation member 11, it will flow promptly and it will fall.

[0042] Next, in a cleaning process, the ring magnet 6 goes up again and the substrate W is horizontally held with the revolving hold pins 15. And the substrate attaching part 1 rotates by the motor 3, and the substrate W rotates at the rate of predetermined. In this cleaning process, while pure water is breathed out on the substrate W from a pure water feeding nozzle (not shown) and the surface of the substrate W is washed, a rinse (pure water) is breathed out from the back rinse nozzle 9 (refer to drawing 2), and the rear face of the substrate W is washed.

[0043] After washing processing of the surface of the substrate W and a rear face is completed, it shifts to a drying stage. In a drying stage, the number of rotations of the motor 3 is raised and the substrate W rotates at high speed. The pure water supplied to the surface of the substrate W is shaken off by this by the method of outside, and the surface of the substrate W is dried.

[0044] Thus, a developing solution adhering, becoming mist in a post process, and polluting the surface of the substrate W is prevented by having formed the surface of the rotation member 11, or the surface of the revolving hold pins 15 in water repellence. A developing solution can invade and solidify in the crevice between the pin fixed parts 17 of the revolving hold pins 15 and the magnet attaching part 19, and the attaching member 22, and it can prevent barring the rotational operation of the revolving hold pins 15.

[0045] When a developing solution becomes difficult to adhere to the substrate attaching part 1 and the substrate attaching part 1 is maintained by the pure state, the cycle of maintenance services, such as washing of the substrate attaching part 1, can be lengthened.

---

[Translation done.]

**\* NOTICES \***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

**DESCRIPTION OF DRAWINGS**

---

**[Brief Description of the Drawings]**

[Drawing 1] It is a sectional view of the revolving developer in one embodiment of this invention.

[Drawing 2] It is a top view of the developer of drawing 1.

[Drawing 3] It is a perspective view of revolving hold pins and an attaching member.

[Drawing 4] It is an expanded sectional view near [ in a developer ] the revolving hold pins.

[Drawing 5] It is a cross section of the conventional developer.

**[Explanations of letters or numerals]**

1 Substrate attaching part

11 Rotation member

14 Holding pin

15 Revolving hold pins

16 Pin member

17 Pin fixed parts

18 Connecting shaft

19 Magnet storage part

21 Bearing storage part

22 Attaching member

23 Bearing

---

[Translation done.]

**\* NOTICES \***

JPO and INPIT are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.

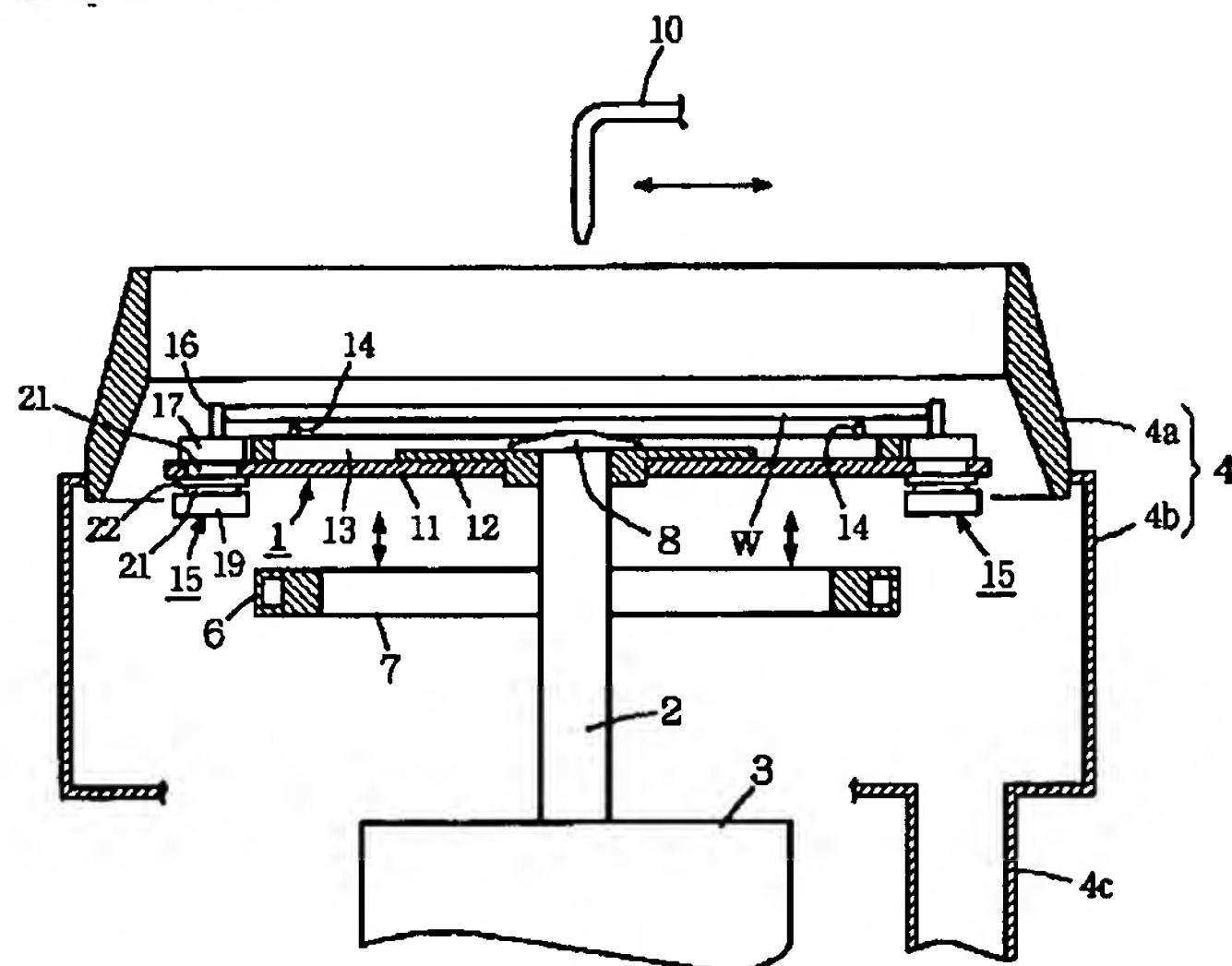
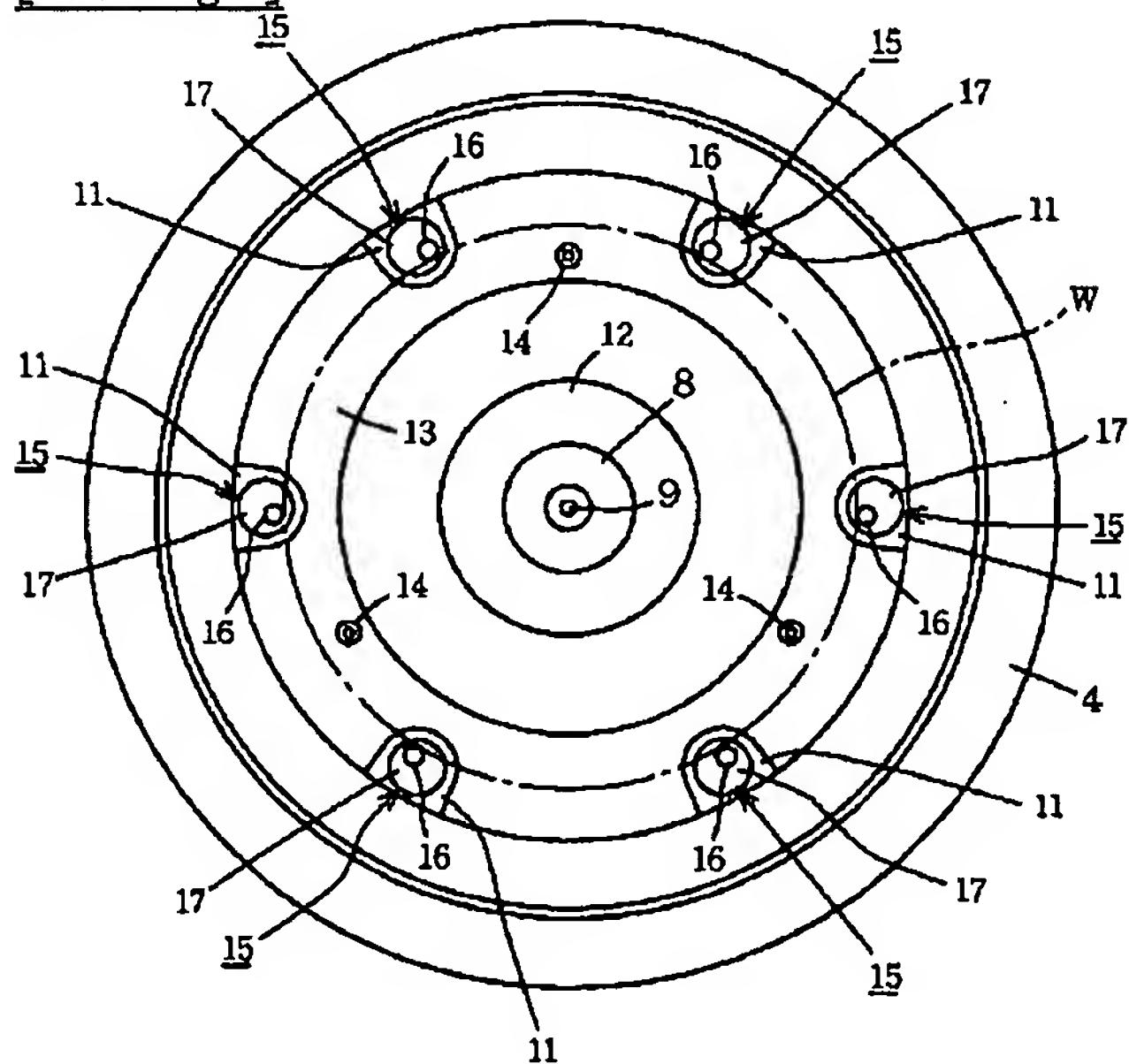
2. \*\*\*\* shows the word which can not be translated.

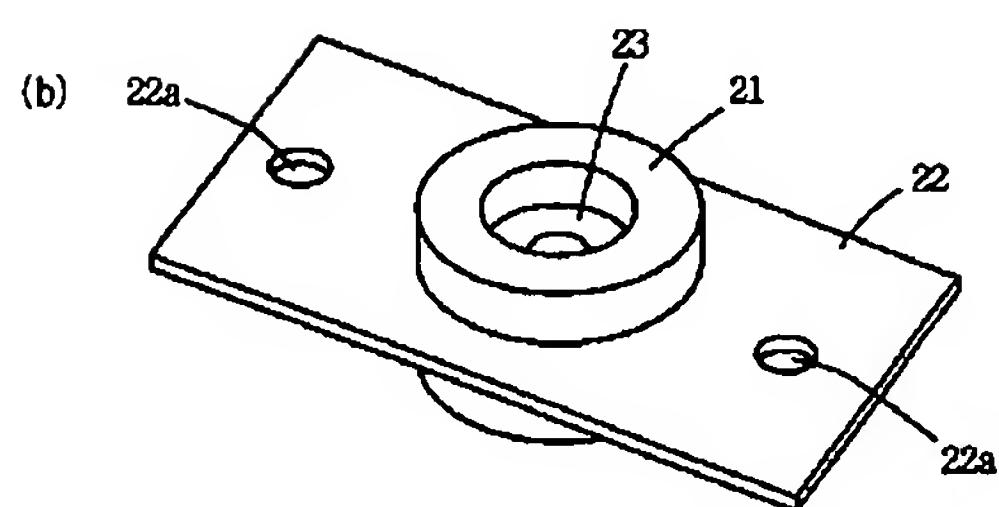
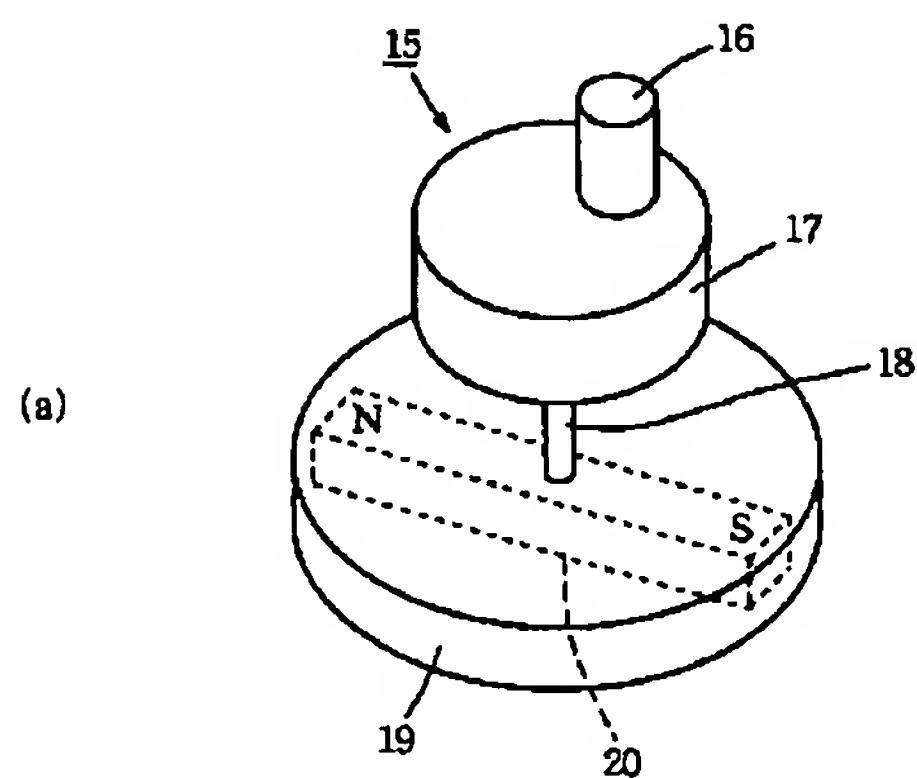
3. In the drawings, any words are not translated.

---

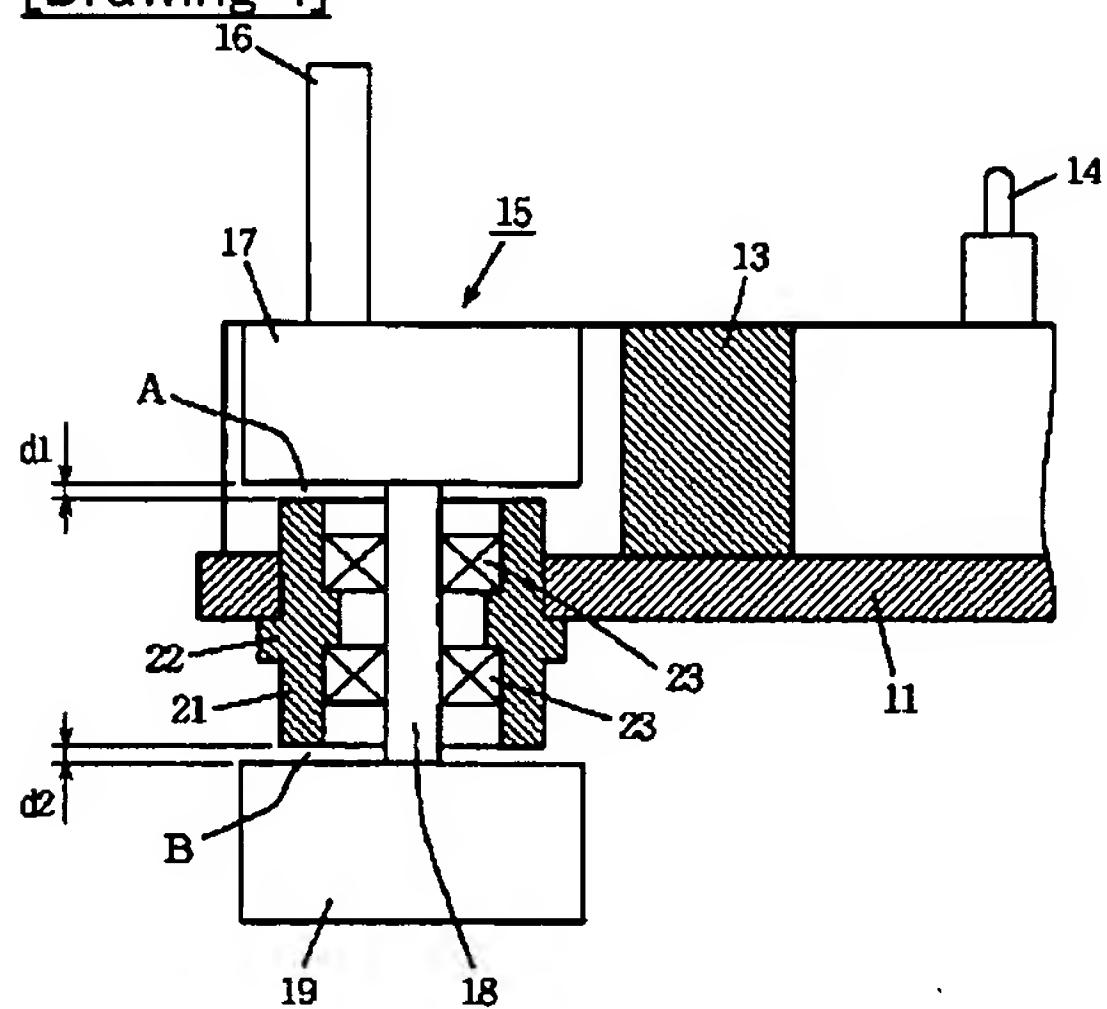
**DRAWINGS**

---

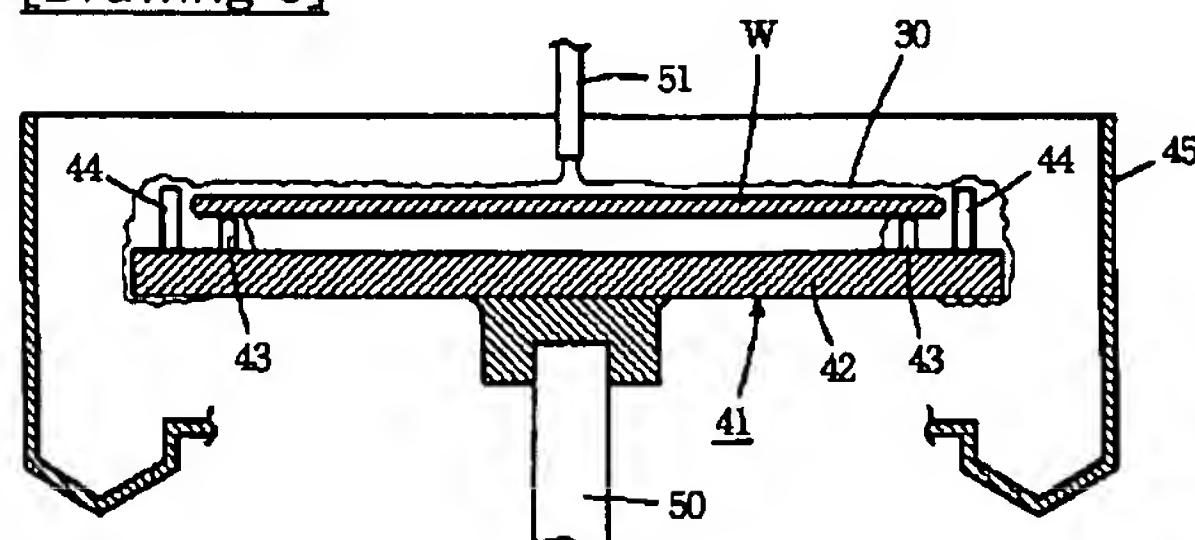
**[Drawing 1]****[Drawing 2]****[Drawing 3]**



[Drawing 4]



[Drawing 5]




---

[Translation done.]

(19)日本国特許庁 (JP)

(12) 公開特許公報 (A)

(11)特許出願公開番号

特開平11-239758

(43)公開日 平成11年(1999)9月7日

(51)Int.Cl.<sup>6</sup>

B 05 C 11/08

G 03 F 7/30

H 01 L 21/027

識別記号

5 0 2

F I

B 05 C 11/08

G 03 F 7/30

H 01 L 21/30

5 0 2

5 6 9 C

審査請求 未請求 請求項の数4 OL (全 6 頁)

(21)出願番号

特願平10-44893

(22)出願日

平成10年(1998)2月26日

(71)出願人 000207551

大日本スクリーン製造株式会社

京都府京都市上京区堀川通寺之内上る4丁

目天神北町1番地の1

(72)発明者 矢部 学

京都市伏見区羽束師古川町322番地 大日

本スクリーン製造株式会社洛西事業所内

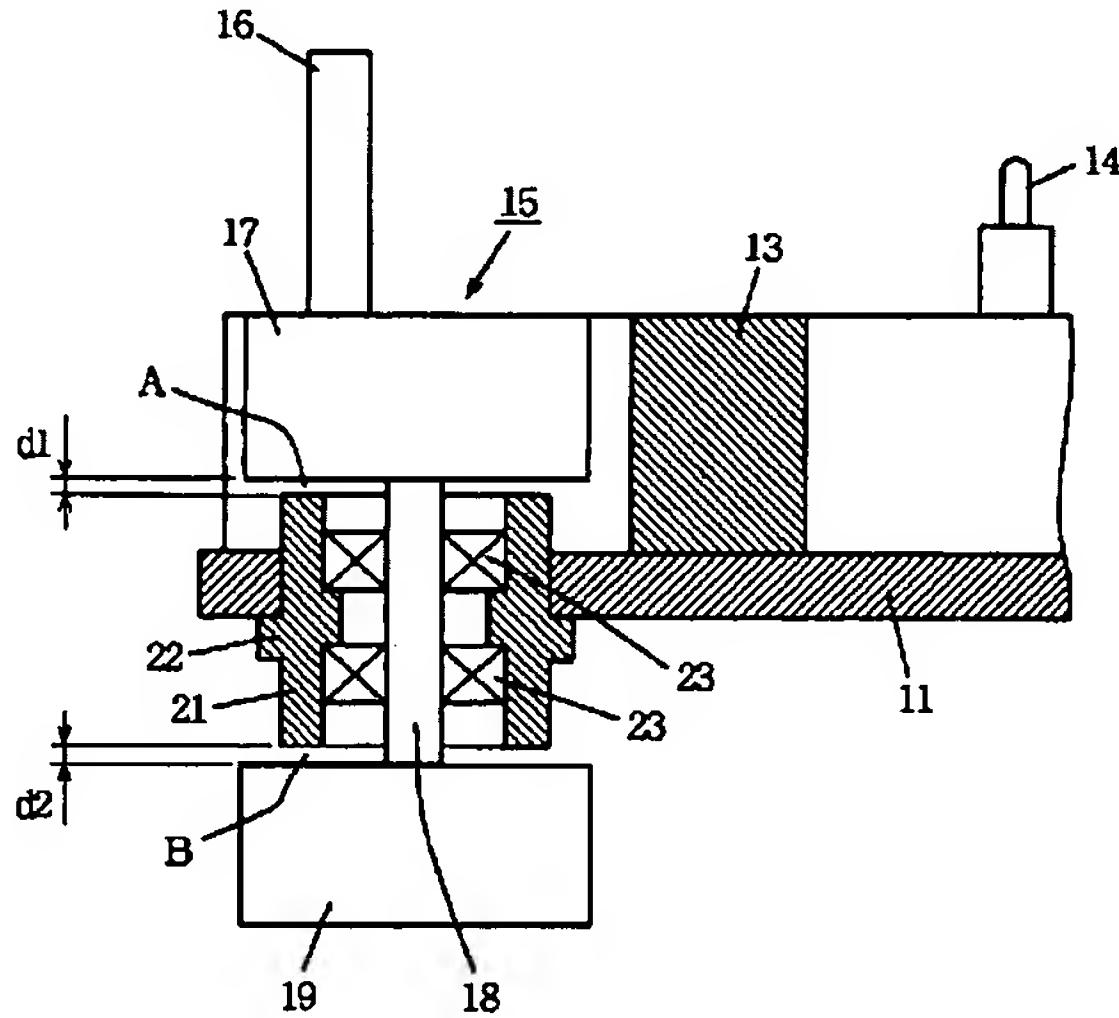
(74)代理人 弁理士 福島 祥人

(54)【発明の名称】 基板処理装置

(57)【要約】

【課題】 基板を回転保持する部材に付着した処理液のミストによる基板の汚染が防止された基板処理装置を提供する。

【解決手段】 基板保持部1の回転部材11は、基板Wを支持する複数の支持ピン14と基板Wの水平位置を規制する回転式保持ピン15とを備え、モータ3の回転軸2の上端に固定されて回転駆動される。回転部材11は金属の表面にフッ素系樹脂コーティングを施したもの、あるいはアルミニウム母材の表面にニッケルーポリテトラフルオロエチレンめっきを施したもの等が用いられる。回転式保持ピン15のピン固定部17、磁石収納部19および取り付け部材22はポリプロピレン等の撥水性樹脂から形成されており、固定部17および磁石収納部19と取り付け部材22との隙間A、Bは0.5mm以上1.0mm以下に調整されている。



## 【特許請求の範囲】

【請求項1】 基板を回転させつつ基板に所定の処理を行う基板処理装置であって、  
回転自在な回転部材と、  
基板の外周部に沿うように前記回転部材上に設けられ、  
基板の外周端部に当接して基板を保持する複数の保持部材と、  
前記回転部材を回転駆動する駆動手段と、  
前記複数の保持部材により保持された基板に処理液を供給する処理液供給手段とを備え、  
前記複数の保持部材により保持された基板の表面に対向する前記回転部材の表面が撥水性を有することを特徴とする基板処理装置。

【請求項2】 前記各保持部材は、  
前記回転部材を貫通して鉛直方向に延びる回転軸と、  
前記回転部材に固定され、前記回転軸を回転自在に支持する取り付け部と、  
前記回転軸の上端に取り付けられた支持部と、  
前記支持部の回動に伴って基板の外周端部に当接するよう前記回転軸に対して偏心して前記支持部上に設けられた保持部と、  
前記回転軸の下端に取り付けられ、前記支持部の回動のための磁力を発生する磁石を収納する磁石収納部とを備え、  
少なくとも前記取り付け部と前記支持部との間の隙間ににおける前記取り付け部および前記支持部の表面と、前記取り付け部と前記磁石収納部との間の隙間ににおける前記取り付け部および前記磁石収納部の表面とが撥水性を有することを特徴とする請求項1記載の基板処理装置。

【請求項3】 前記取り付け部と前記支持部との間の隙間および前記取り付け部と前記磁石保持部との隙間が0.5mm以上1.0mm以下であることを特徴とする請求項2記載の基板処理装置。

【請求項4】 前記回転部材の表面における水に対する接触角が70°以上180°以下であることを特徴とする請求項1～3のいずれかに記載の基板処理装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】 本発明は、基板を回転させつつ処理液を基板に供給して所定の処理を行う基板処理装置に関する。

## 【0002】

【従来の技術】 半導体ウエハ、液晶表示装置用ガラス基板、フォトマスク用ガラス基板、光ディスク用ガラス基板等の基板に種々の処理を行うために回転式の基板処理装置が用いられている。たとえば、基板の表面に形成された感光性膜の現像処理には、回転式の現像装置が用いられている。この現像装置を用いた基板の現像処理は、現像液供給、現像液保持、純水洗浄および乾燥の各工程からなる。

【0003】 図5は従来の現像装置の概略断面図であり、現像液供給工程を示している。図5において、現像装置は基板Wを保持する基板保持部41を備える。基板保持部41は、モータ(図示せず)の回転軸50の先端部に水平に固定されかつ鉛直方向の軸の周りで回転駆動される回転部材42を備える。回転部材42の上面には、基板Wの裏面を支持する複数の支持ピン43が設けられるとともに、基板Wの外周端部に当接して基板Wの水平方向の位置を規制する複数の規制ピン44が設けられている。

【0004】 基板保持部41の上方には、現像液を吐出する現像ノズル51が上下方向および水平方向に移動可能に設けられている。現像ノズル51は、現像液供給前および現像液供給後に基板Wの上方から外れた位置に待機し、現像液供給時に基板Wの中心部の上方に移動する。

【0005】 この現像装置を用いた現像液供給工程では、基板Wが基板保持部41に保持された後、モータにより基板保持部41が回転駆動され、この状態で基板Wの上方に移動した現像ノズル51から基板W上に現像液30が吐出され、回転に伴う遠心力により基板Wの全面に塗り広げられる。

【0006】 現像液保持工程では、基板保持部41の回転が停止され、現像液30が基板Wの全面に塗り広げられた状態で基板Wが一定時間静止される。これにより、基板Wの感光性膜の現像が進行する。

【0007】 純水洗浄工程では、基板保持部41が再び回転駆動され、基板Wの表面に純水供給ノズル(図示せず)から純水が供給され、基板Wの表面の純水洗浄が行われる。

【0008】 乾燥工程では、純水の供給が停止された後、基板保持部41が高速で回転駆動され、回転に伴う遠心力により基板Wの表面から純水が振り切られる。これにより、基板Wが乾燥する。その後、基板保持部41の回転が停止し、基板Wの現像処理が終了する。

## 【0009】

【発明が解決しようとする課題】 図5に示す現像液供給工程では、基板保持部41に保持された基板Wが低速で回転駆動された状態で現像液ノズル51から現像液30が基板Wの表面に吐出される。現像液30が基板Wの全面に均一に行き渡るよう多く吐出されると、現像液30は基板Wの外周部から支持ピン43や規制ピン44を伝わり回転部材42に流れ落ち、回転部材42の外周部に付着する。

【0010】 その後、基板Wの回転が停止されると、回転部材42に落下した現像液30の付着領域が広がり、現像液30の一部は回転部材42の下面側に回り込み、付着する。

【0011】 上記したように、現像液供給工程の後には、現像液保持工程を経て純水洗浄工程が行われる。純

水洗浄工程では、基板Wの表面に純水が供給され、基板Wの表面が洗浄される。このとき、純水は回転部材42側にも流れ落ち、先の現像液供給工程において回転部材42に付着した現像液30を部分的に洗い流す。

【0012】しかしながら、純水は基板保持部41が回転している状態で供給されるため、基板Wの外方側に向かって遠心力を受ける。このため、純水は、静止時に回転部材42の上面や下面に広がった現像液30を完全に洗い流すことができず、回転部材42の上面や下面に現像液30の付着領域が残余する。

【0013】この現像液の付着領域は、乾燥工程において基板保持部41が高速回転されると、カップ45内にミスト（液体粒子）となって浮遊し、基板Wの表面に再付着して基板Wを汚染する。また、長期間にわたって回転部材42の上面および下面に付着した現像液が固化すると、現像液の固化物によるパーティクル（塵埃）が発生し、カップ45内に浮遊して基板Wを汚染する。

【0014】本発明の目的は、基板を回転保持する部材に付着した処理液のミストによる基板の汚染が防止された基板処理装置を提供することである。

#### 【0015】

【課題を解決するための手段および発明の効果】第1の発明に係る基板処理装置は、基板を回転させつつ基板に所定の処理を行う基板処理装置であって、回転自在な回転部材と、基板の外周部に沿うように回転部材上に設けられ、基板の外周端部に当接して基板を保持する複数の保持部材と、回転部材を回転駆動する駆動手段と、複数の保持部材により保持された基板に処理液を供給する処理液供給手段とを備え、複数の保持部材により保持された基板の表面に対向する回転部材の表面が撥水性を有するものである。

【0016】第1の発明に係る基板処理装置においては、複数の保持部材によって回転部材上に保持された基板が駆動手段により回転駆動される。処理液供給手段は回転部材上の基板に処理液を供給し、基板に対して所定の処理を行わせる。処理液供給手段から多量の処理液が基板に供給されると、その一部は基板から回転部材上に流れ落ちる。回転部材の表面は撥水性を有している。このため、回転部材上に流れ落ちた処理液は回転部材の表面で弾かれ、回転部材の回転により外方へ飛散される。これにより、処理液が回転部材の表面に付着することが妨げられ、回転部材の表面に付着した処理液がミストとなって基板表面を汚染することを防止することができる。

【0017】第2の発明に係る基板処理装置は、第1の発明に係る基板処理装置の構成において、各保持部材が、回転部材を貫通して鉛直方向に延びる回転軸と、回転部材に固定され、回転軸を回転自在に支持する取り付け部と、回転軸の上端に取り付けられた支持部と、支持部の回動に伴って基板の外周端部に当接するように回転

軸に対して偏心して支持部上に設けられた保持部と、回転軸の下端に取り付けられ、支持部の回動のための磁力を発生する磁石を収納する磁石収納部とを備える。さらに、少なくとも取り付け部と支持部との間の隙間における取り付け部および支持部の表面と、取り付け部と磁石収納部との間の隙間における取り付け部および磁石収納部の表面とが撥水性を有するものである。

【0018】各保持部材の保持部は基板の外周端部に当接して基板を水平方向に保持する。このため、基板に供給された処理液の一部は保持部を通り、取り付け部、支持部および磁石収納部を伝って流れ落ちる。保持部材では、回転部材に対して回転軸が回転自在となるように取り付け部と支持部の間および取り付け部と磁石収納部の間に隙間が設けられている。そして、この隙間における取り付け部と支持部の表面および取り付け部と磁石収納部の表面が撥水性を有するように形成されている。このため、基板から流れ落ちた処理液はこれら表面の撥水性により隙間内に侵入することが妨げられる。それゆえ、取り付け部および磁石収納部と支持部との各隙間に処理液が侵入し、侵入した処理液が後工程においてミストとなって飛散して基板を汚染することが防止される。さらに、各隙間に侵入した処理液が固化して保持部材の回転軸の回転動作を妨げることを防止することができる。

【0019】第3の発明に係る基板処理装置は、第2の発明に係る基板処理装置の構成において、取り付け部と支持部との間の隙間および取り付け部と磁石保持部との隙間が0.5mm以上1.0mm以下であるものである。

【0020】取り付け部と支持部との隙間および取り付け部と磁石保持部との隙間を0.5mm以上1.0mm以下とすることにより、各隙間内の表面の撥水作用により処理液が各隙間に侵入することを防止することができる。各隙間が0.5mmより小さい場合には、取り付け部と支持部および取り付け部と磁石保持部との隙間が微小となり、各部材の取り付けに高精度が要求され、組み立て作業が困難となる。また、各隙間が1.0mmより大きい場合には、各隙間内の表面の撥水性の作用が小さくなり、各隙間に処理液が侵入する。したがって、各隙間を上記の値に設定することにより各隙間への処理液の侵入を防止することができる。

【0021】第4の発明に係る基板処理装置は、第1～第3のいずれかの発明に係る基板処理装置の構成において、回転部材の表面における水に対する接触角が70°以上180°以下であるものである。

【0022】この場合、回転部材の表面の水に接する接触角が70°より小さい場合には、処理液を十分に弾くことが困難となる。したがって、水に対する接触角が70°以上180°以下とすることにより、回転部材に流れ落ちる処理液を外方へ飛散して処理液の付着を防止することができる。

## 【0023】

【発明の実施の形態】図1は本発明の一実施例による回転式の現像装置の断面図であり、図2は図1中の現像装置の平面図である。

【0024】図1および図2において、基板保持部1は円形板状の回転部材11を備える。回転部材11は、アルミニウムを母材に使用し、基板Wの表面に對向する表面にニッケルーポリテトラフルオロエチレンめっきが施されている。ニッケルーポリテトラフルオロエチレンめっきの水に対する接触角は約100°と大きく、現像液を弾くことができる。また、他の例としては、アルマイトに撥水性の樹脂を含浸処理したもの、あるいはチタン合金等の金属材料の表面にフッ素系樹脂をコーティング(被膜処理)したものを用いてもよい。

【0025】回転部材11は、モータ3の回転軸2の先端に取り付け部材12を介して水平に固定され、鉛直方向の軸の周りで回転駆動される。

【0026】回転部材11の上面には、樹脂からなる環状のカバー部材13が形成されており、このカバー部材13の上面から、基板Wの裏面を支持する複数の支持ピン14が突出している。

【0027】また、回転部材11には、基板Wの水平位置を規制する複数の回転式保持ピン15が鉛直方向の軸の周りで回動可能に取り付けられている。図3は回転式保持ピン(a)および取り付け部材(b)の斜視図である。さらに、図4は現像装置における回転式保持ピン近傍の拡大断面図である。図3(a)および図4において、回転式保持ピン15は、円柱状のピン固定部17、円柱状(棒状)のピン部材16、連結軸18および磁石収納部19を備える。ピン部材16は、ピン固定部17の上面に、ピン固定部17の中心に対して偏心して設けられている。磁石収納部19は、ピン固定部17の下部に連結軸18を介して固定されている。磁石収納部19内には棒状の永久磁石20が収納されている。

【0028】回転式保持ピン15は取り付け部材22により回転部材11に取り付けられる。図3(b)において、取り付け部材22は1対の取り付け孔22aを有し、回転部材11(図1参照)の下面外周にねじ止め固定される。取り付け部材22はベアリング収納部21を有し、ベアリング収納部21内に収納されたベアリング23の軸孔内に回転式保持ピン15の連結軸18が挿通される。これにより、図4に示すように、回転式保持ピン15のピン部材16およびピン固定部17が回転部材11の上面側に突出し、回転式保持ピン15の磁石収納部19が回転部材11の下面側に突出する。

【0029】回転式保持ピン15において、ピン部材16、ピン固定部17、取り付け部材22および磁石収納部19は撥水性を有するポロプロピレン、あるいはポリテトラフルオロエチレン等の樹脂から形成されている。ポリプロピレンの水に対する接触角は約80°、ポリテ

10

トラフルオロエチレンの接触角は90~100°であり、共に高い撥水性を有している。このため、被着した現像液を弾き、流下させることができる。なお、これらの部材は上記の撥水性を有する樹脂材料で形成するのみならず、金属材料の表面にポリテトラフルオロエチレン等の撥水性材料をコーティングしたもの、あるいはフッ化グラファイト等の表面処理を施したもの用いてもよい。フッ化グラファイトの水に対する接触角は140~180°である。

20

【0030】また、図4において、ピン固定部17と取り付け部材21との間に形成される隙間Aおよび取り付け部材22と磁石収納部19との間に形成される隙間Bの間隔d1, d2は0.5mm以上1mm以下に調整される。各隙間A, Bにおけるピン固定部17、取り付け部材22および磁石収納部19の表面は撥水性を有している。このため、各隙間の間隔d1, d2を1mm以下に調整することにより、隙間A, Bを介して対向する各部材の表面の撥水性により現像液が弾かれ、隙間A, Bを通過することが妨げられる。これにより、ベアリング保持部21内に現像液が侵入して滞留したり、非撥水性のベアリング23に現像液が被着することが防止される。また、各隙間の間隔d1, d2が0.5mmより小さくなると、隙間の調整に高い精度が要求され、組み立て作業が困難となる。

【0031】回転部材11の下方には環状磁石6が配設されている。この環状磁石6は、駆動装置(図示せず)により上下動自在に設けられた磁石支持部材7に固定されている。

30

【0032】磁石支持部材7が上昇すると、環状磁石6と回転式保持ピン15の永久磁石20とが引き合い、回転式保持ピン15が回転してピン部材16が基板Wの外周端部に当接して基板Wの水平方向の位置を保持する。また、磁石支持部材7が下降すると、回転式保持ピン15が逆方向に回動し、ピン部材16が基板Wの外周端部から離間する。このような動作により、基板Wの外周端部が回転式保持ピン15により保持され、あるいは開放される。

40

【0033】モータ3の回転軸2は中空軸により構成され、その内部に基板の裏面洗浄用のバッククリンスノズル9(図2参照)が挿入されている。このバッククリンスノズル9は取り付け部材12を貫通して基板Wの裏面側に突出している。バッククリンスノズル9の先端には、円錐台状のキャップ8が取り付けられている。キャップ8は、バッククリンスノズル9から吐出される rins液(純水)が回転軸2の内部に侵入することを防止するために取り付けられている。

50

【0034】また、基板保持部1の上方には、現像液を吐出する現像ノズル10が上下方向および水平方向に移動可能に設けられている。この現像ノズル10は、現像処理前および現像処理後に基板Wの上方から外れた位置

に待機し、現像処理時に基板Wの中心部の上方に移動する。

【0035】さらに、基板保持部1の周囲を取り囲むように中空のカップ4が配設されている。カップ4は上下方向に移動可能な上カップ4aと、上カップ4aの下方に固定された下カップ4bとからなる。下カップ4bの下部には現像装置の上方からカップ4内に下降される清浄な空気の下降流(ダウンフロー)を排気するための排気口4cが設けられている。

【0036】本実施例において、回転式保持ピン15が本発明の保持部材に相当し、モータ3が駆動手段に相当し、現像ノズル10が処理液供給手段に相当する。また、回転式保持ピン15のピン部材16が本発明の保持部に相当し、ピン固定部17が支持部に相当し、連結軸18が回転軸に相当し、磁石収納部19が磁石収納部に相当し、取り付け部材22が取り付け部に相当する。

【0037】次に、図1の現像装置における現像処理時の動作について説明する。この現像装置においては、上方から清浄なダウンフローがカップ4の内外に供給されつつ現像処理が行われる。現像処理では、現像液供給、現像液保持、純水洗浄および乾燥の各工程が順に行われる。

【0038】まず、基板Wが基板保持部1の支持ピン14上に載置される。次に、環状磁石6が上昇して複数の回転式保持ピン15が基板Wを水平方向に保持する。

【0039】現像液供給工程では、モータ3により基板保持部1が低速で回転駆動された状態で、現像ノズル10から基板W上に現像液が吐出される。吐出された現像液は基板Wの全面に均一に塗り広げられる。

【0040】現像ノズル10からは比較的多量の現像液が吐出される。このため、現像液の一部は回転式保持ピン15を伝わり回転部材11に流れ落ちる。回転式保持ピン15および回転部材11の表面は撥水性を有している。このため、基板Wから流れ落ちた現像液は回転式保持ピン15および回転部材11の表面に付着することなく基板保持部1の回転により外方に飛散される。

【0041】さらに、現像液保持工程では、基板保持部1の回転が停止される。基板保持部1が停止されると、環状磁石6が下降して回転式保持ピン15が開放状態となる。この状態で、現像液が基板W上に一定時間静止保持される。これにより、基板W上の感光性膜の現像が進行する。この場合には、現像液は回転式保持ピン15および回転部材11の表面に付着することなくはじかれた状態で回転部材11の表面に載っており、回転部材11の回転により遠心力が働けば、速やかに流れ落ちる。

【0042】次に、洗浄工程では、環状磁石6が再び上

昇して回転式保持ピン15により基板Wが水平方向に保持される。そして、モータ3により基板保持部1が回転駆動され、基板Wが所定の速度で回転する。この洗浄工程では純水供給ノズル(図示せず)から基板W上に純水が吐出されて基板Wの表面が洗浄されるとともに、バッククリンスノズル9(図2参照)からリンス液(純水)が吐出されて基板Wの裏面が洗浄される。

【0043】基板Wの表面および裏面の洗浄処理が終了すると、乾燥工程に移行する。乾燥工程では、モータ3の回転数が高められ、基板Wが高速で回転される。これにより、基板Wの表面に供給された純水が外方に振り切られ、基板Wの表面が乾燥される。

【0044】このように、回転部材11の表面あるいは回転式保持ピン15の表面を撥水性に形成したことにより、現像液が付着し、後工程においてミストとなって基板Wの表面を汚染することが防止される。また、回転式保持ピン15のピン固定部17および磁石保持部19と取り付け部材22との隙間に現像液が侵入して固化し、回転式保持ピン15の回動動作を妨げることを防止することができる。

【0045】さらに、基板保持部1に現像液が付着しにくくなり、基板保持部1が清浄な状態に維持されることにより基板保持部1の洗浄等の保守作業の周期を長くすることができる。

#### 【図面の簡単な説明】

【図1】本発明の一実施例における回転式の現像装置の断面図である。

【図2】図1の現像装置の平面図である。

【図3】回転式保持ピンおよび取り付け部材の斜視図である。

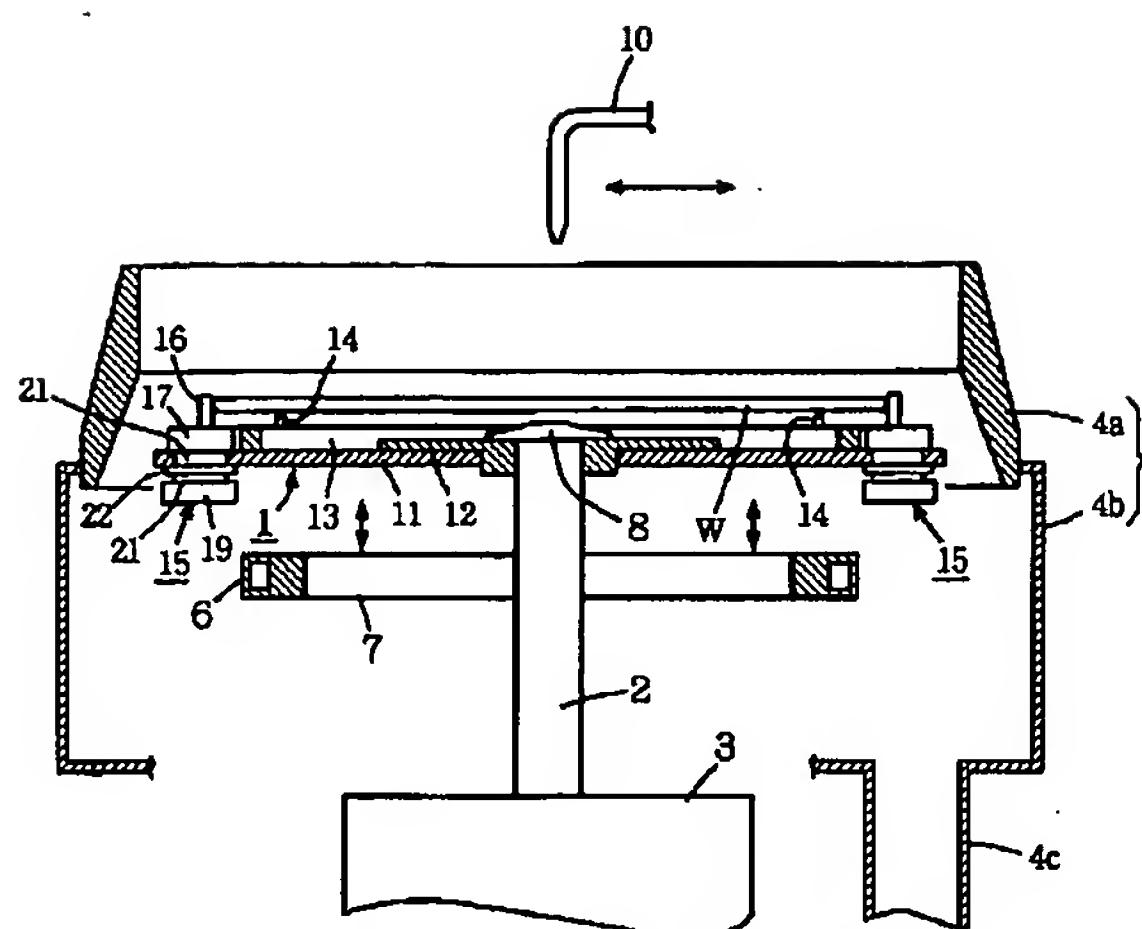
【図4】現像装置における回転式保持ピン近傍の拡大断面図である。

【図5】従来の現像装置の断面模式図である。

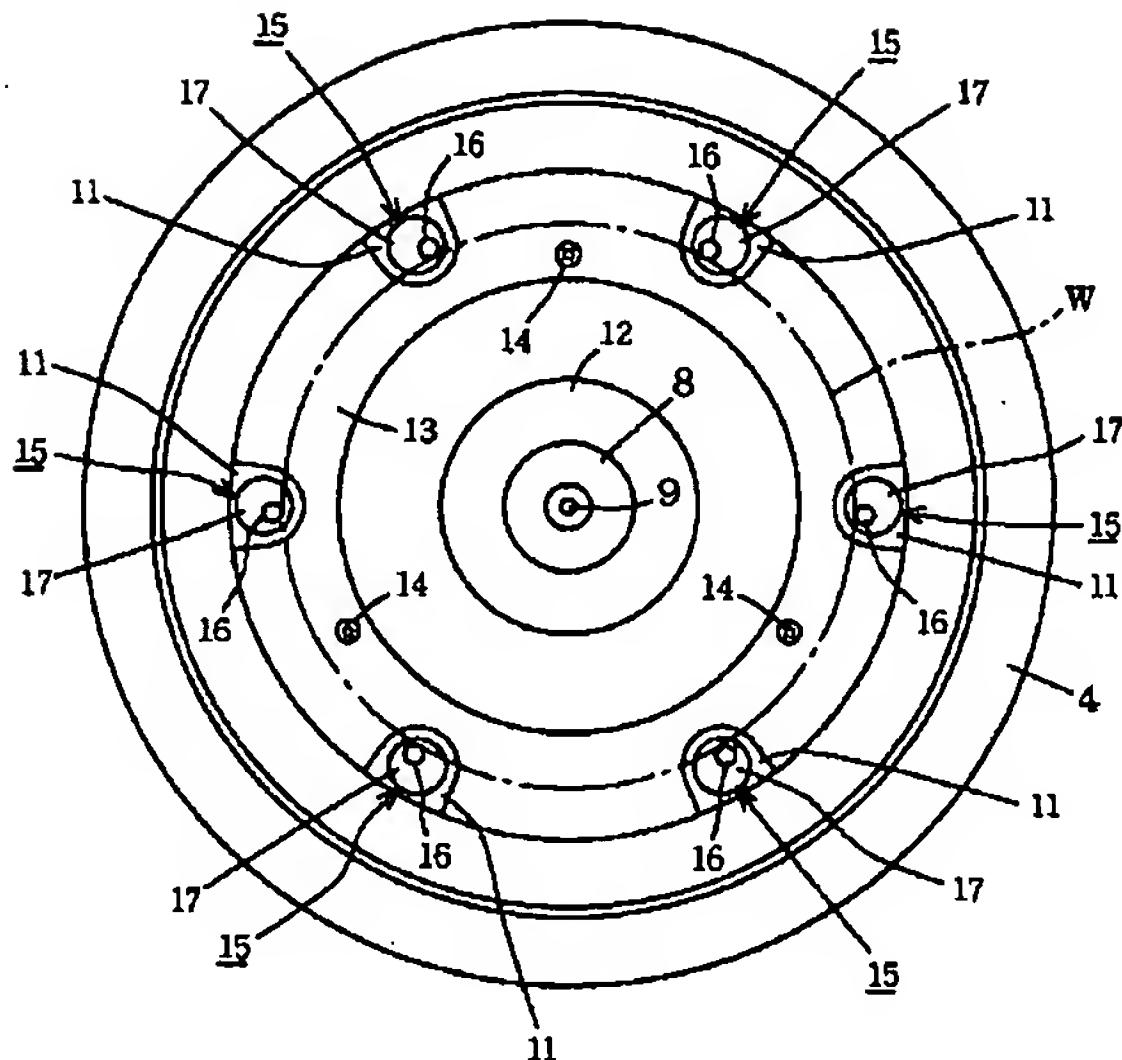
#### 【符号の説明】

1	基板保持部
11	回転部材
14	支持ピン
15	回転式保持ピン
16	ピン部材
17	ピン固定部
18	連結軸
19	磁石収納部
21	ベアリング収納部
22	取り付け部材
23	ベアリング

【图 1】

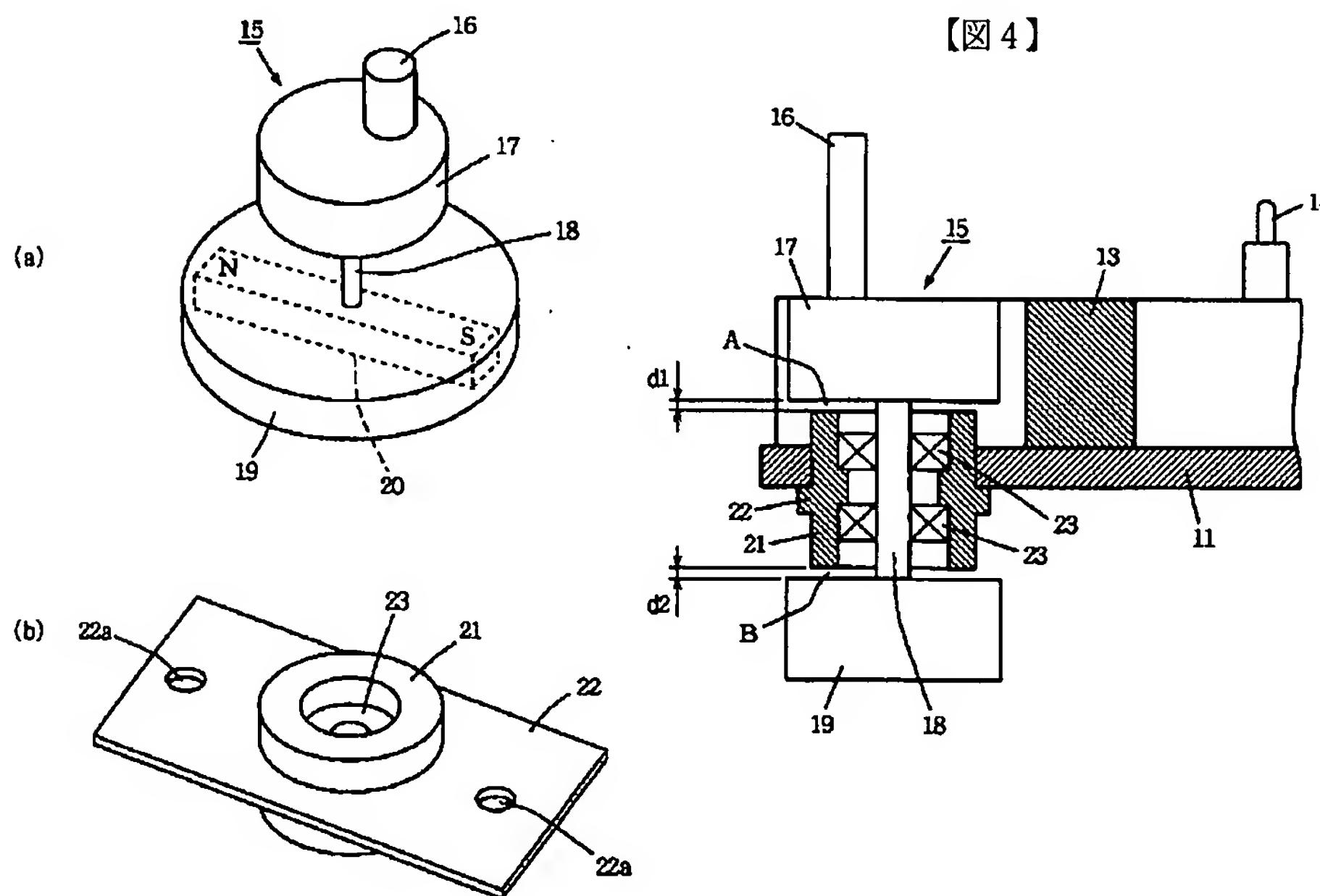


[図2]



【图3】

【図4】



[囗 5]

